Figure 6.1 a&b The Total Energy of the Universe is Constant

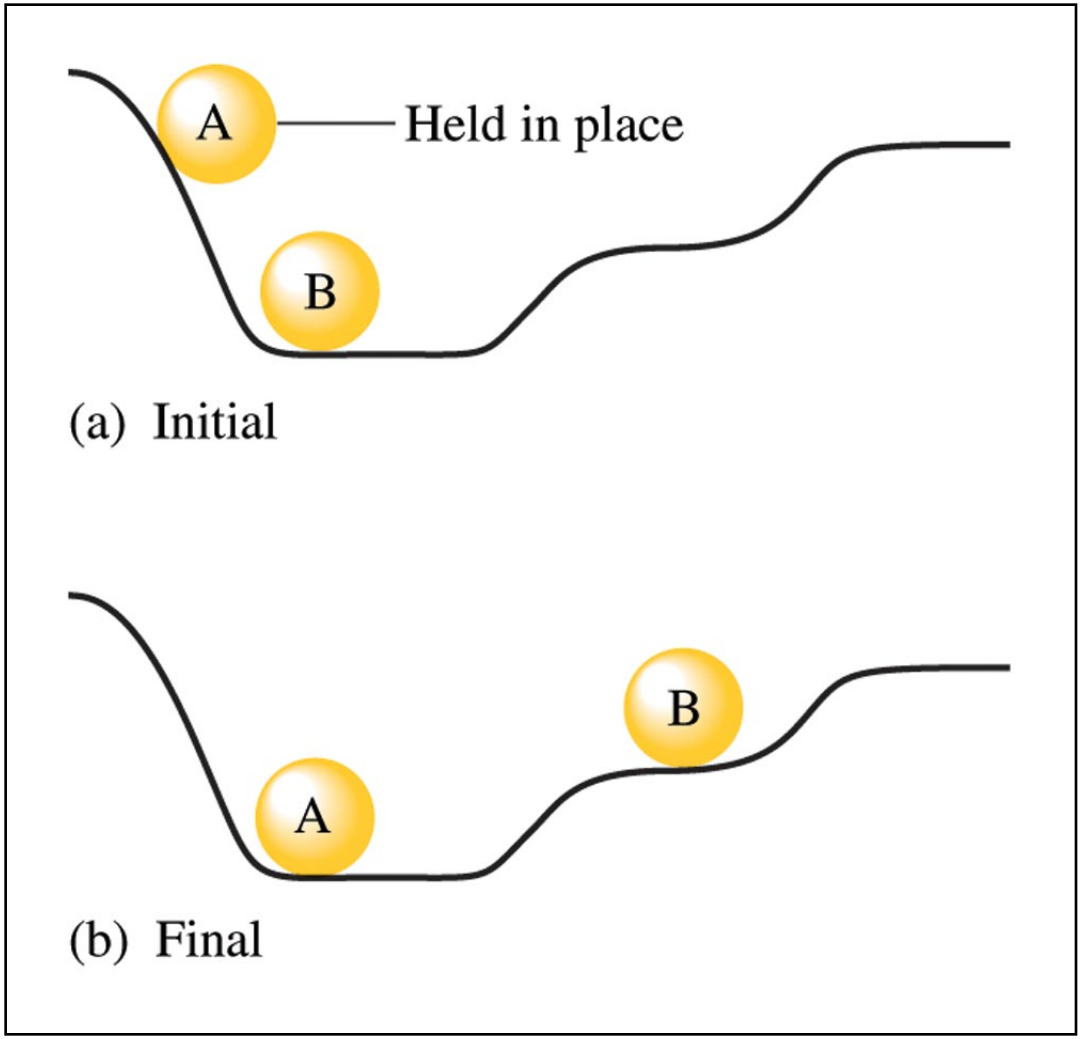


Figure 6.2 Exothermic Process

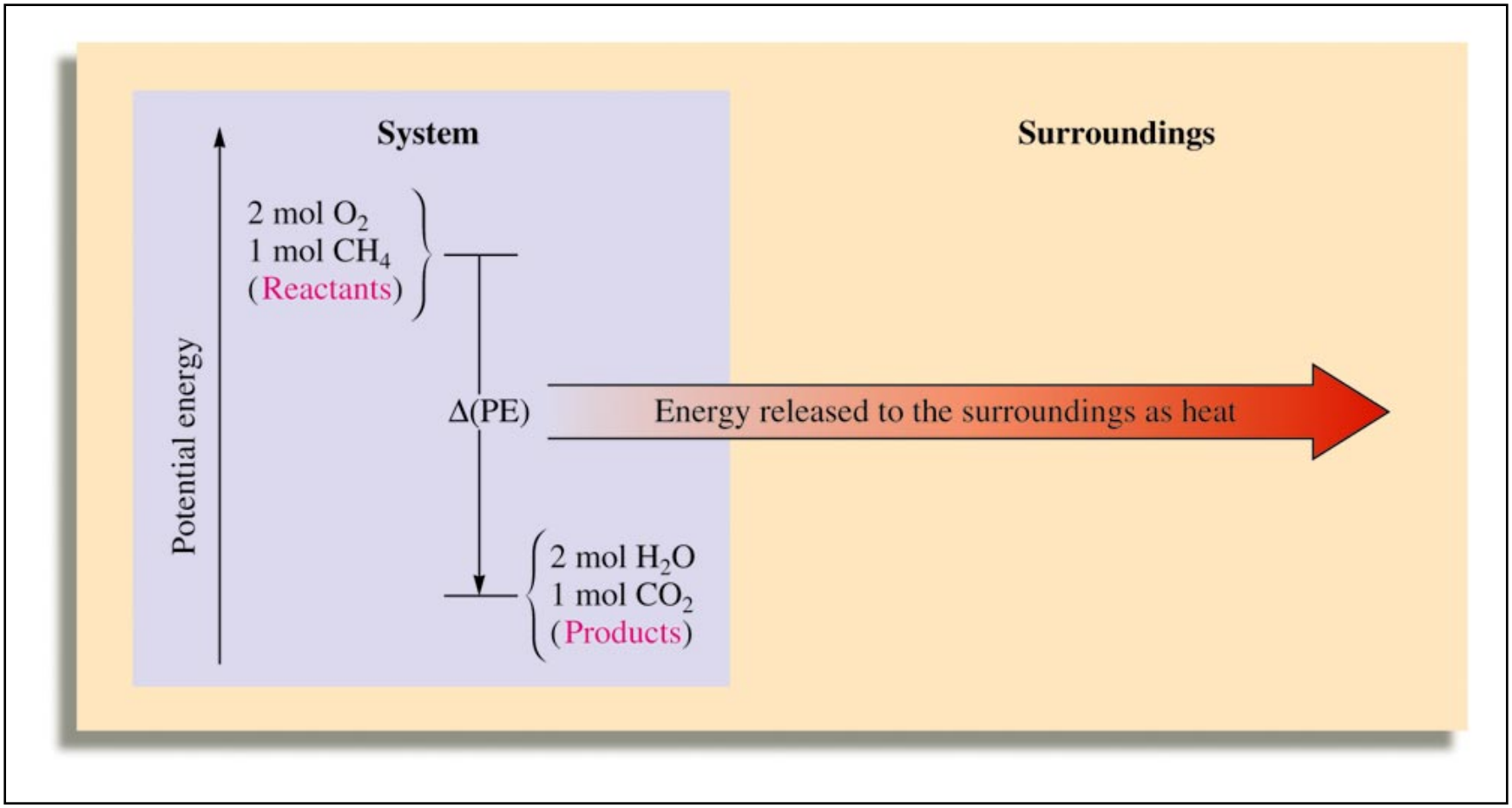
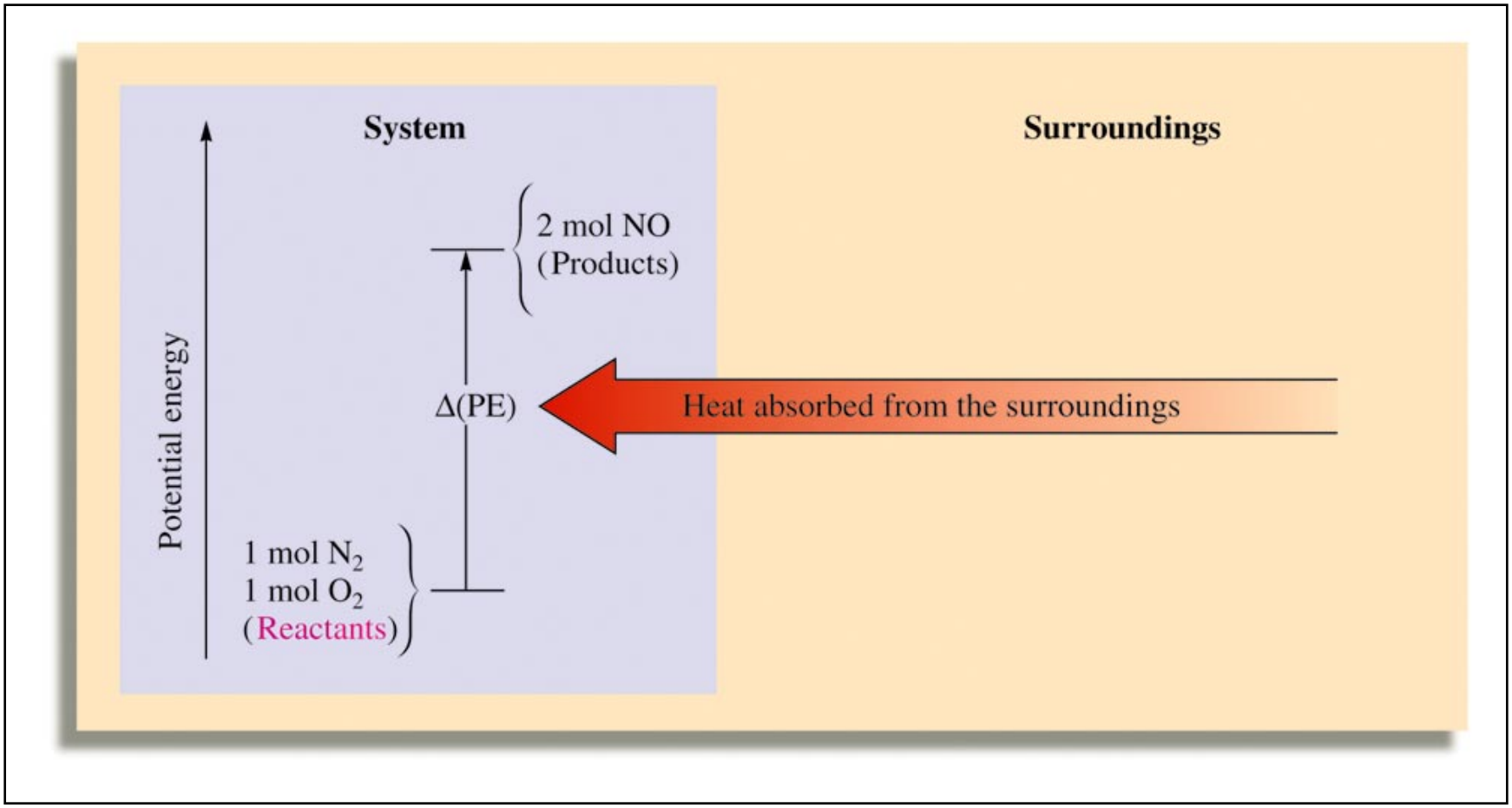


Figure 6.3 Endothermic Process



Thermodynamic Quantities

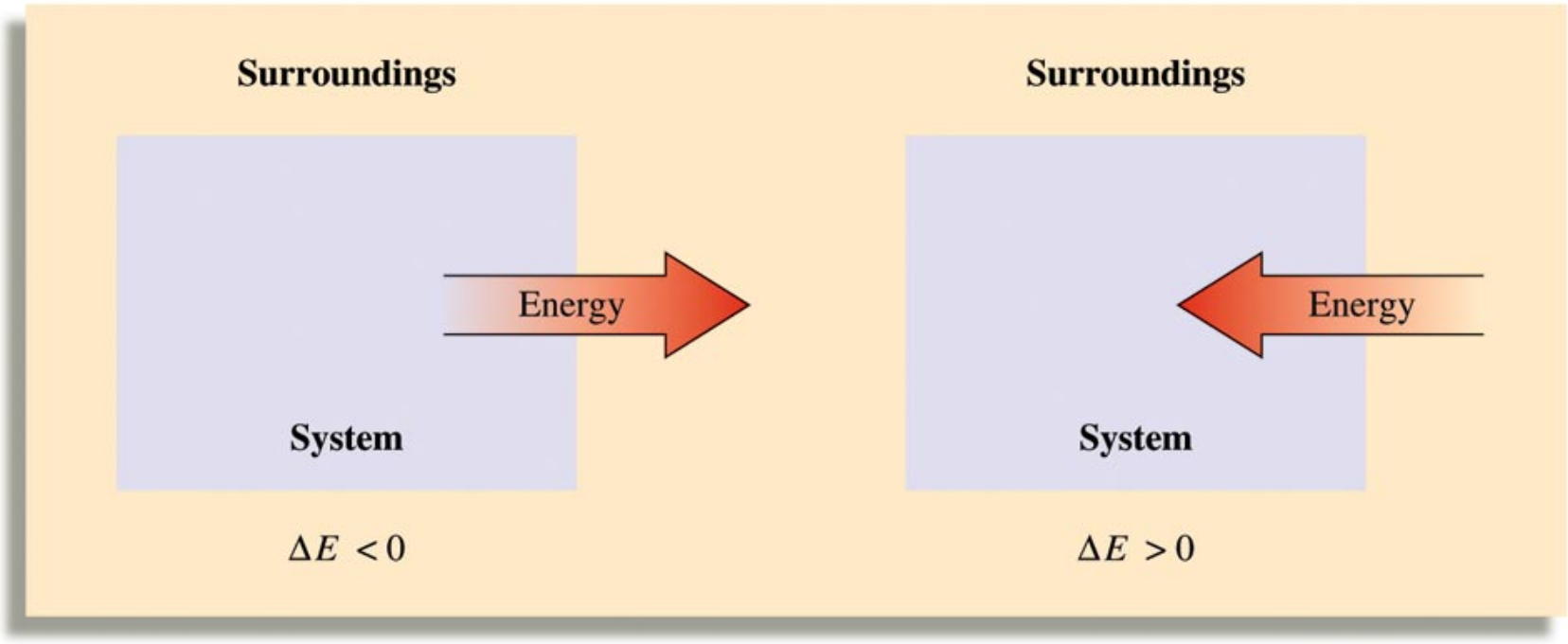
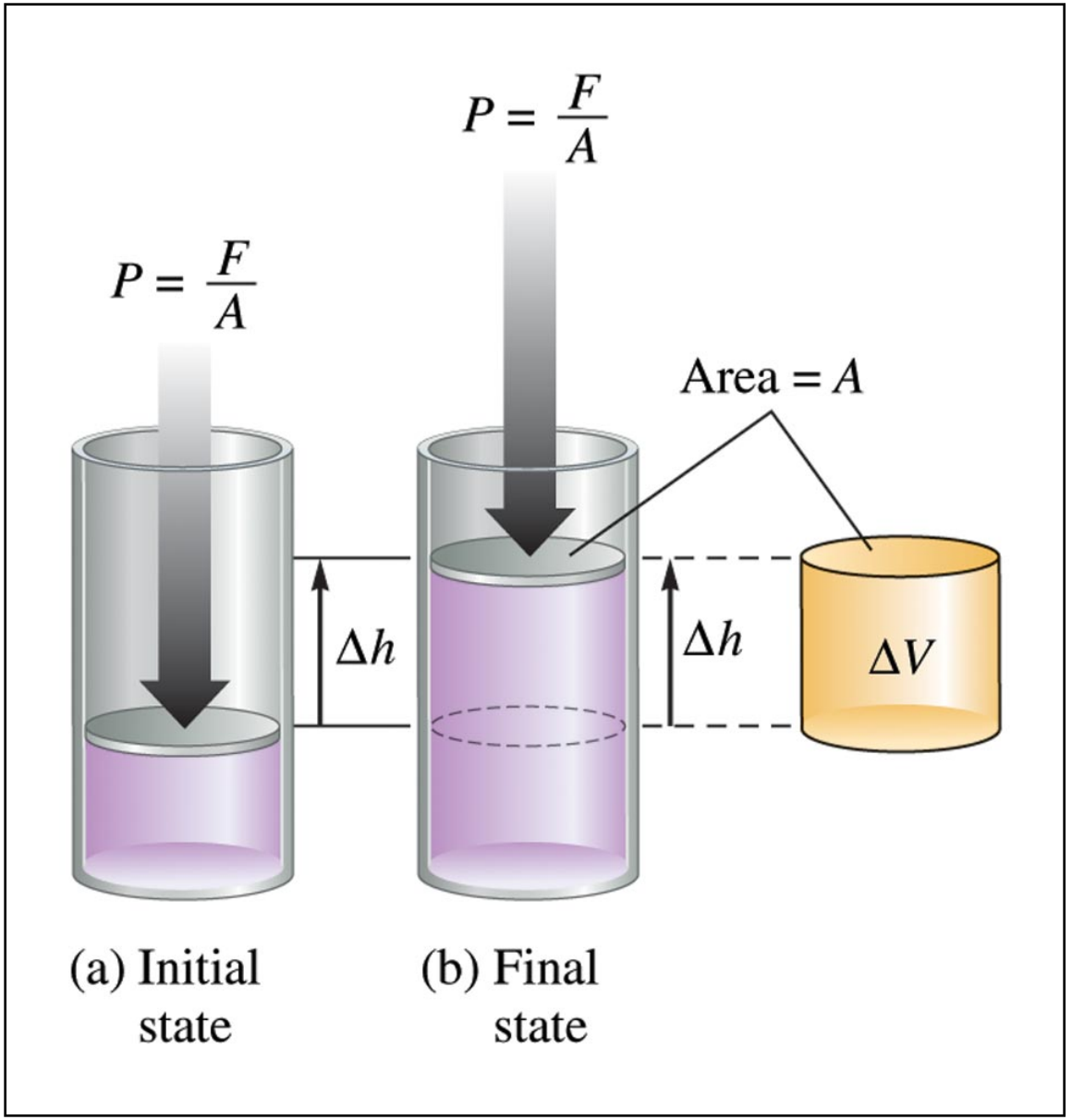


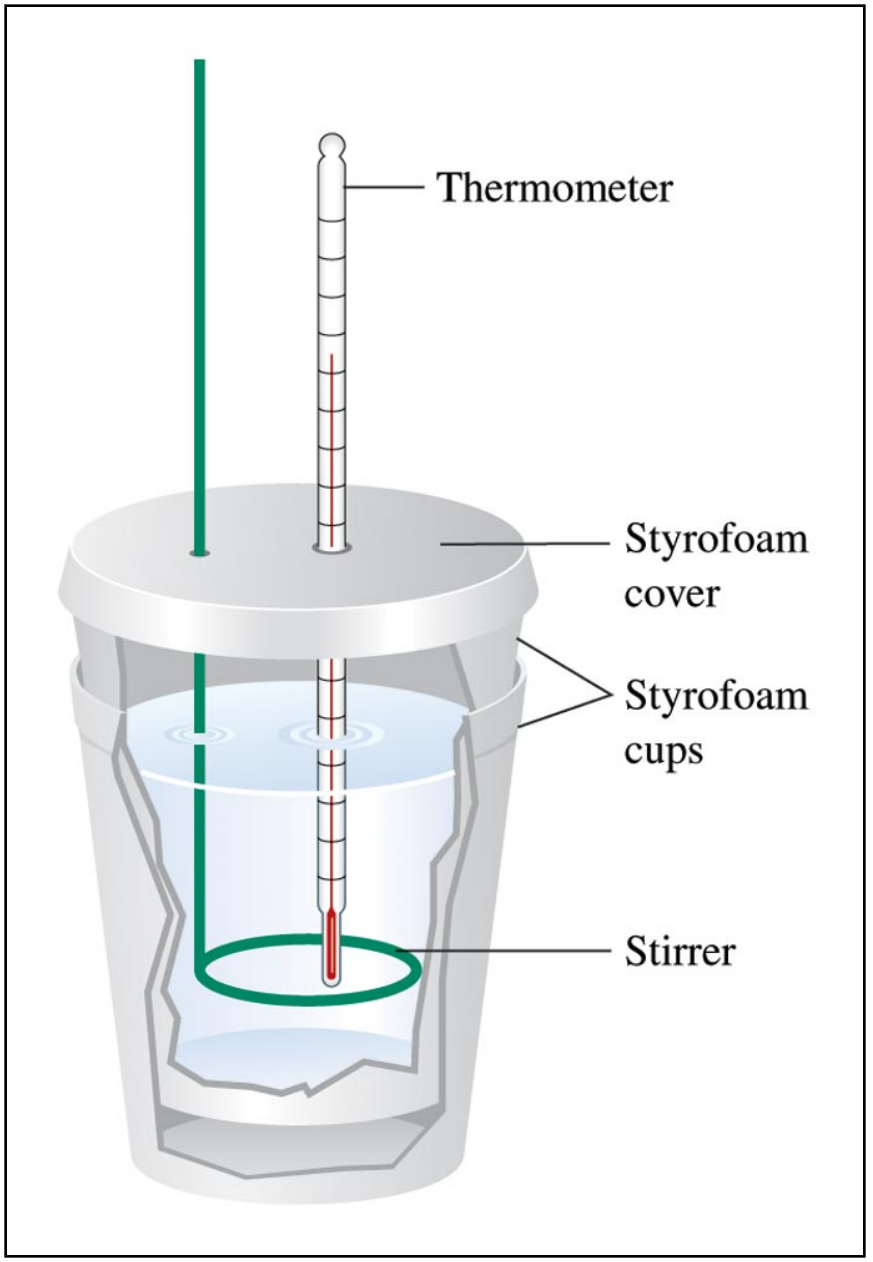
Figure 6.4 The Piston, Moving a Distance Against a Pressure P, Does Work On the Surroundings



When 1.0 mole of methane is burned at constant pressure, 890 kJ of energy is released as heat. Calculate the *H* for a process when a 5.8 g sample of methane is burned at a constant pressure.

-320 kJ

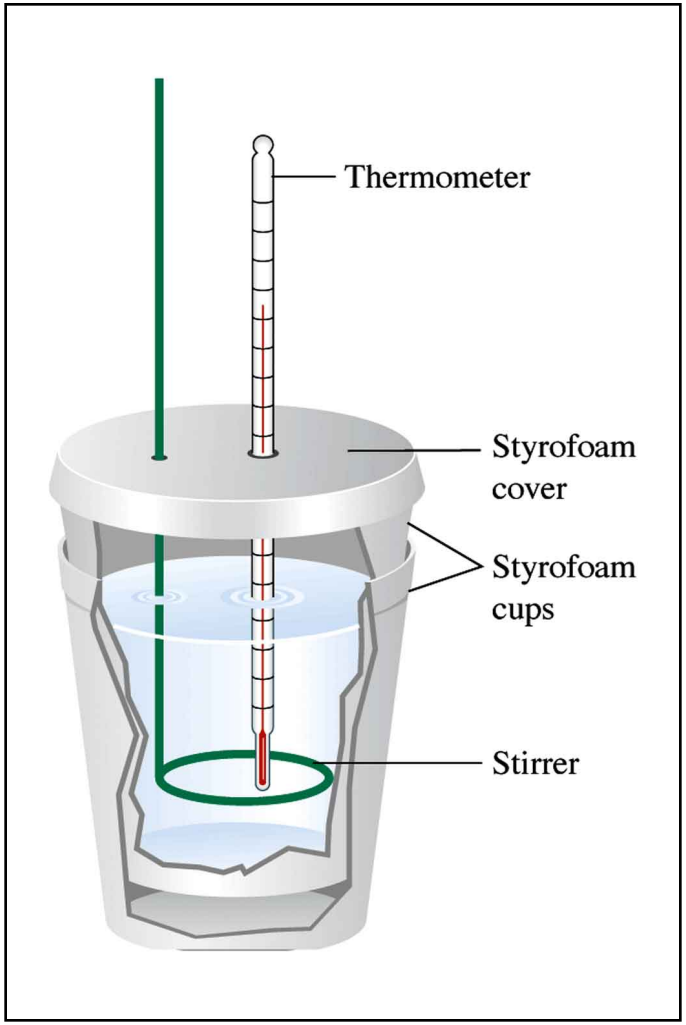
Figure 6.5
A Coffee-Cup Calorimeter Made of Two Styrofoam Cups



QUESTION (continued)

The instant cold packs associated with athletic injuries makes use of the heat change when NH_4NO_3 dissolves. If 8.0 grams of NH_4NO_3 were placed in 100.0 mL of water such as shown in the constant pressure calorimeter, and the temperature change was – 6.0°C, what would you calculate as the ΔH for dissolving one mole of NH_4NO_3?

1. –2 500 kJ/mol
2. +2 500 kJ/mol
3. –25 kJ/mol
4. +25 kJ/mol



When 50.0 mL of 1.00 M HCl at 25.0oC is mixed with an equal volume of 1.00 M NaOH at 25.0oC, the temperature of the mixture rises to 31.9oC. How much energy was released and how much energy would be released in kJ per mole of reactant?

Figure 6.6 A Bomb Calorimeter.

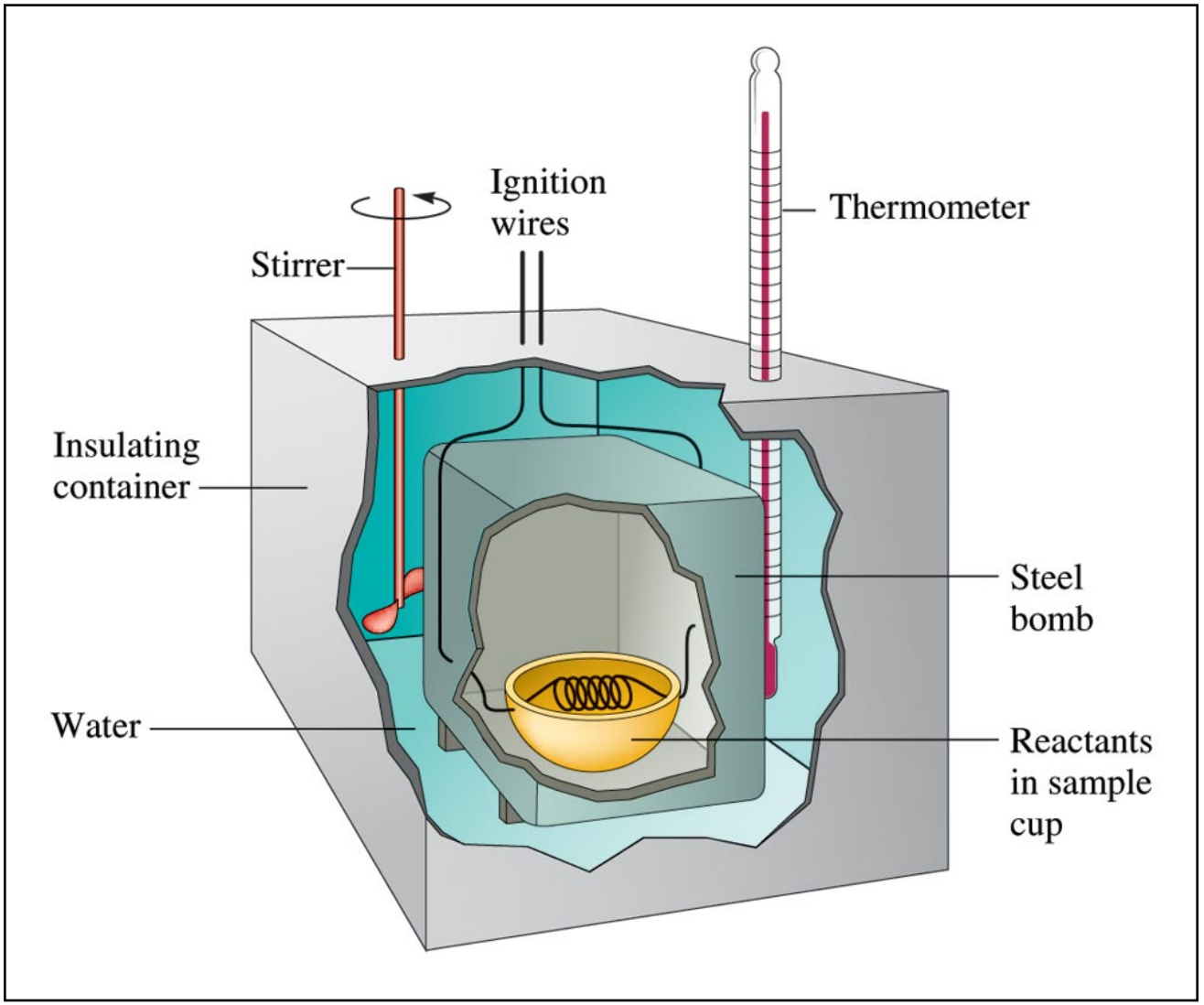


Figure 6.6
A Bomb
Calorimeter

QUESTION

The heat capacity of a calorimeter of the type shown on the previous slide must be determined before other investigations, using the instrument, can be performed. When 0.500 0 grams of pure carbon are combusted in the "bomb" the temperature rose by 1.842°C, (Note: use –393.5 kJ/mol as the heat of combustion for carbon.) What is the calorimeter's heat capacity?

1. 30.20 kJ/°C
2. 106.8 kJ/K
3. 8.901 kJ/°C
4. 35.60 kJ/°C

QUESTION

A certain small piece of candy is made of 1.525 grams of sucrose ($C_{12}H_{22}O_{11}$; molar mass = 342.12 g). When placed in a bomb calorimeter with a specific heat of 5.024 kJ/°C, how much should the temperature rise when the candy undergoes combustion? (Note: use –5 640 kJ/mol as the heat released for the combustion of one mole of sucrose.)

1. 5.00°C
2. 126°C
3. 25.1°C
4. Couldn't I just eat the candy, I am not sure what to do with the calculations.

The Thermite Reaction is One of the Most Energetic Chemical Reactions

Table 6.1 The Specific Heat Capacities of Some Common Substances

TABLE 6.1 The Specific Heat Capacities of Some Common Substances

Substance	Specific Heat Capacity (J/°C · g)
$H_2O(l)$	4.18
$H_2O(s)$	2.03
$Al(s)$	0.89
$Fe(s)$	0.45
$Hg(l)$	0.14
$C(s)$	0.71

Table 6.2 Standard Enthalpies of Formation for Several Compounds at 25°C

TABLE 6.2 Standard Enthalpies of Formation for Several Compounds at 25°C

Compound	ΔH_f° (kJ/mol)
$NH_3(g)$	−46
$NO_2(g)$	34
$H_2O(l)$	−286
$Al_2O_3(s)$	−1676
$Fe_2O_3(s)$	−826
$CO_2(g)$	−394
$CH_3OH(l)$	−239
$C_8H_{18}(l)$	−269